WHAT IS CLAIMED IS:

1. A radio frequency (RF) down-convertor with reduced local oscillator leakage, for demodulating an input signal *x(t)*, comprising:

a synthesizer for generating ~~time-varying~~mixing signals φ_1 and φ_2 which vary irregularly over time, where $\varphi_1 * \varphi_2$ has significant power at the frequency of a local oscillator signal being emulated, and neither φ_1 nor φ_2 has significant power at the frequency of said local oscillator signal being emulated;

a first mixer coupled to said synthesizer for mixing said input signal *x(t)* with said ~~time-varying~~mixing signal φ_1 to generate an output signal *x(t)* φ_1; and

a second mixer coupled to said synthesizer and to the output of said first mixer for mixing said signal *x(t)* φ_1 with said ~~time-varying~~mixing signal φ_2 to generate an output signal *x(t)* φ_1 φ_2.

2. The radio frequency (RF) down-convertor of claim 1 wherein said synthesizer further comprises:

a synthesizer for generating ~~time-varying~~mixing signals φ_1 and φ_2, where $\varphi_1 * \varphi_1 * \varphi_2$ does not have a significant amount of power within the bandwidth of said input signal *x(t)* at baseband.

3. The radio frequency (RF) down-convertor of claim 2, further comprising:

a DC offset correction circuit.

4. The radio frequency (RF) down-convertor of claim 3, wherein said DC offset correction circuit comprises:

a DC source having a DC output; and

a summer for adding said DC output to an output of one of said mixers.

5. The radio frequency (RF) down-convertor of claim 2, further comprising:

a closed loop error correction circuit.

6. The radio frequency (RF) down-convertor of claim 5, wherein said closed loop error correction circuit further comprises:

an error level measurement circuit and

a time-varying signal modification circuit for modifying a parameter of one of said ~~time-varying~~mixing signals φ_1 and φ_2 to minimize said error level.

7. The radio frequency (RF) down-convertor of claim 6, wherein said error level measurement circuit comprises a power measurement.

8. The radio frequency (RF) down-convertor of claim 6, wherein said error level measurement circuit comprises a voltage measurement.

9. The radio frequency (RF) down-convertor of claim 6, wherein said error level measurement circuit comprises a current measurement.

10. The radio frequency (RF) down-convertor of claim 6, wherein said modified parameter is the phase delay of one of said ~~time-varying~~mixing signals φ_1 and φ_2.

11. The radio frequency (RF) down-convertor of claim 6, wherein said modified parameter is the fall or rise time of one of said ~~time-varying~~mixing signals φ_1 and φ_2.

12. The radio frequency (RF) down-convertor of claim 6, wherein said modified parameter includes both the phase delay and the fall or rise time of one of said ~~time-varying~~ mixing signals φ_1 and φ_2.

13. The radio frequency (RF) down-convertor of claim 2 wherein said synthesizer further comprises:

a synthesizer for generating ~~time-varying~~mixing signals φ_1 and φ_2, where said ~~time-varying~~mixing signals φ_1 and φ_2 can change with time in order to reduce errors.

14. The radio frequency (RF) down-convertor of claim 1, further comprising:

a filter for removing unwanted signal components from said $x(t)$ φ_1 signal.

15. The radio frequency (RF) down-convertor of claim ~~2~~1, wherein said ~~time-varying~~mixing signals φ_1 and φ_2 are random.

16. The radio frequency (RF) down-convertor of claim 1, wherein said ~~time-varying~~mixing signals φ_1 and φ_2 are pseudo-random.

17. The radio frequency (RF) down-convertor of claim 1, wherein said ~~time-varying~~mixing signals φ_1 and φ_2 are irregular.

18. The radio frequency (RF) down-convertor of claim 1, wherein said ~~time-varying~~mixing signals φ_1 and φ_2 are digital waveforms.

19. The radio frequency (RF) down-convertor of claim 1, wherein said ~~time-varying~~mixing signals φ_1 and φ_2 are square waveforms.

20. The radio frequency (RF) down-convertor of claim 1, further comprising:

a local oscillator coupled to said synthesizer for providing a signal having a frequency that is an integral multiple of the desired mixing frequency.

21. A method of demodulating a radio frequency (RF) signal *x(t)* with reduced local oscillator leakage comprising the steps of:

generating ~~time-varying~~mixing signals φ_1 and φ_2 which vary irregularly over time, where φ_1 and $*\varphi_2$ has significant power at the frequency of a local oscillator signal being emulated, and neither φ_1 nor φ_2 has significant power at the frequency of said local oscillator signal being emulated;

mixing said input signal *x(t)* with said ~~time-varying~~mixing signal φ_1 to generate an output signal *x(t)* φ_1; and

mixing said signal *x(t)* φ_1 with said ~~time-varying~~mixing signal φ_2 to generate an output signal *x(t)* φ_1 φ_2.

22. An integrated circuit comprising the radio frequency (RF) down-convertor of ~~any one of claims 1-20~~ claim 1.

~~23. A computer readable memory medium, storing computer software code in a hardware development language for fabrication of an integrated circuit comprising the radio frequency (RF) down-convertor of any one of claims 1-20 claim 1.~~

~~24. A computer data signal embodied in a carrier wave, said computer data signal comprising computer software code in a hardware development language for~~

~~fabrication of an integrated circuit comprising the radio frequency (RF) down-convertor of any one of claims 1–20 claim 1.~~

25. The radio frequency (RF) down-converter of claim 1, wherein said synthesizer uses a single time base to generate both mixing signals φ_1 and φ_2.

26 The radio frequency (RF) down-converter of claim 1, where said synthesizer uses different patterns to generate signals φ_1 and φ_2.